Memorandum

To: Catherine Kuhlman, Executive Officer, North Coast Regional Water Quality Control Board

From: Humboldt Watersheds Independent Scientific Review Panel: Andrew Collison, Fred Everest, William Emmingham, William Haneberg, Richard Marston, David Tarboton, and Robert Twiss

Re: Independent Science Review Panel Responses to Questions Submitted at the August 26, 2003 Workshop on the Phase II ISRP Report

Date: September 8, 2003

At your request, we have continued our deliberations, and developed responses to the written questions submitted on the Panel's Phase II report.

Introduction

The NCRWQCB convened a public workshop on August 26, 2003 at the NCRWQCB offices in Santa Rosa, California. The goal of the workshop was to present the Regional Board with the findings from the Phase II Report of the Independent Science Review Panel on Sediment Impairment and Effects on Beneficial Uses of the Elk River and Stitz, Bear, Jordan, and Freshwater Creeks. Four of the seven Panelists were in attendance to present the Report on behalf of the entire Panel and to answer questions posed by the Regional Board. These Panelists were Drs. Andrew Collison, Fred Everest, William Haneberg, and Robert Twiss.

The primary purpose of the Workshop was to create an opportunity for the Panelists to present the Report and then for Regional Board members to pose questions and engage in dialogue with Panelists. The secondary purpose of the Workshop was to provide an opportunity for landowners, resource agencies, residents and stakeholders to learn of the Panel's findings and pose written questions to the Panel. Attendees at the Workshop included PALCO representatives, state and federal resource agencies, Regional Board staff, and representatives of residents and environmental organizations.

In addition to the questions submitted in writing at the Workshop, which are quoted as written by the submitter, the Regional Board also invited written comments and questions in advance of the Workshop. The questions listed below include both sets of questions, which have been

rearranged here by topic. The questions were compiled and submitted to the Panel by CONCUR, Inc. Answers to the questions have been written and reflect the consensus of the entire Panel.

Submitters of Questions

Prior to the Workshop, five letters were submitted to the Panel via CONCUR by:
- Carlton Yee, Registered Professional Forester (August 20, 2003)
- PALCO (August 21, 2003)
- Trinda Bedrossian, California Geological Survey (August 21, 2003)
- David Bischel, California Forestry Association (August 21, 2003)
- George Ice, National Council for Air and Stream Improvement, Inc. (August 22, 2003)

Questions posed pertaining to the process of Panel recruitment, deliberation, writing of the Report, and other administrative matters were addressed in the Phase I and Phase II reports, their associated Terms of References, and in the August 26, 2003 workshop.

At the Workshop, questions were submitted to the Panel in writing by:
- Trinda Bedrossian, California Geological Survey
- Mark Rentz, California Forestry Association
- Ken Miller, Humboldt Watersheds Council
- Richard Gienger, Humboldt Watersheds Council
- Cynthia Elkins, Environmental Protection Information Center
- Alsa Levine, Coast Action Group
- Joyce King, Salmon Forever
- Shirley Shelborn

These two sets of questions have been combined and grouped according to topic as listed below. The topics and questions are not listed in any particular order.

Index of Questions by Topic and Phase II Bibliographies

The Panel's Methods and Issue Focus

1. **Question from PALCO -** Throughout the Report the Panel uses terms such as "guarantees of attainment," "ensure attainment of water quality standards," and "relied upon to ensure water quality objectives" in addressing the HCP and its protection measures. What are the Panel's credentials or familiarity relating to relevant state and federal laws pertaining to forestry operations and protection of water quality?

Some Panelists have a strong working knowledge of these processes; some have a moderate knowledge. Knowledge of statutes was not an explicit selection criterion.

2. **Question from PALCO -** The Panel states that the Oregon Forest Practices Rules "provide comprehensive protections for aquatic and riparian habitats at least on par with the California Forest Practice Act and the HCP." This conclusion is not supported by any reference or discussion in the report and appears inaccurate based on any objective comparative analysis. What is the basis for the Panel's conclusion on this matter?

Fred Everest addressed this at the Aug. 26, 2003 Workshop. To elaborate, Oregon FPRs do prescribe comprehensive protection for riparian and aquatic habitats, although their effectiveness remains unknown, just as it does for California's FPRs. For example, some highlights from Oregon FPRs are that it:

- classifies streams into three categories by use and three categories by size for the purpose of assigning forest practices
- prescribes buffers and streamside protections for all classes and sizes of streams
- has specific rules for timber felling and yarding in proximity to streams
- has prescribed practices for controlling mass erosion from steep lands
- has many practices aimed at controlling sediment production and transfer to streams
- has specific rules for construction and maintenance of roads
- designates road crossing structures that will accommodate 50-year recurrence storm events
- mandates upstream and downstream passage for adult and juvenile salmonids in all salmonid habitats

These rules are quite similar to those of other Pacific Coast states, including California, but long-term effectiveness monitoring will be needed in all states to determine how the various rule sets actually protect aquatic and riparian habitats in the long haul.

Geologic Review in the HCP/THP Planning Processes

Questions from Trinda L. Bedrossian, CGS

1. Would the Panel please explain what their understanding of the role of CGS is in these [WA and THP] Processes with regard to generation and review of geologic information?

It is the Panel's understanding that CGS has at least three significant roles. One is generating basic geologic information such as geologic and landslide hazard maps. Another is the promulgation of professional standards and guidelines such as Note 45. The third is the review of timber harvest plans in an advisory capacity to the California Department of Forestry.

2. Also please explain what the Panel means by stating that there is a "lack [of] impartial review" in the current [WA and THP] process.

This was noted at the Aug. 26, 2003 Workshop. The Panel's specific concern is with that impartial **third party** review is not an integral part of the Habitat Conservation Plan, which was the focus of its deliberations. By third party, the Panel means reviewers who have no direct affiliation with either the regulated or the regulators. Constructing roads across potentially unstable slopes after watershed analyses are completed, for example, would require the approval of a licensed geologist without reference to the specific methods used or criteria used to define the acceptable risk of landsliding (particularly with regard to the beneficial uses of water).

The Panel is aware that CGS acts in an advisory capacity and reviews timber harvest plans, but is obligated to point out the fact that the HCP does not require reviews of many decisions that are likely to be based substantially or completely on subjective professional judgement. Moreover, the Panel is concerned that budgetary restrictions will continue to limit the resources that CGS can devote timber harvest plan reviews.

3. On page 15, the Panel concludes that "it cannot offer assurances that pre-harvest field inspections…will be sufficient to address the direct and cumulative effects on water quality." Would the Panel please present the information they gathered from the document review, field trip, and workshop that the found to logically support this conclusion?

CDMG Note 45, Section VI, outlines how cumulative effects should be assessed on the timber harvest plan and watershed scales, but remains silent on the specific methods, techniques, and approaches that might be used to make decisions that are reasonably likely to protect water quality. Note 45, moreover, is a set of guidelines and not enforceable regulations. Therefore, experienced and licensed professionals can make significant departures from the Note 45 guidelines, which makes it difficult to assess the reliability of cumulative effects assessments.

As an example of the information used to support its conclusion, the Panel calls attention to the Freshwater South 23 THP that was provided as an exemplary timber harvest plan. The Mass Erosion section of the cumulative effects section of the document consists of a scant 5 paragraphs occupying about 1/2 page. The section states that active landslides are adjacent to the THP area or in no-cut zones within the THP area, and:

> "Timber operations on this geologic formation could result in (1) land sliding from road and skid rail construction on active unstable slopes or (2) land sliding from complete tree removal could remove tree and root support, increase pore water pressures, and decrease interception and evapo-transpiration." (Freshwater South 23 THP, Section IV, p. 129).

Despite the fact that adjacent forested slopes show signs of current or past instability, neither the cumulative effects assessment nor the other geologic reports included in this THP include the use of limit equilibrium analyses (or more sophisticated analyses such as finite element simulations) with site-specific soils data to evaluate the sensitivity of slope stability to logging activities and likely future precipitation events. In fact, in its review of the Prellwitz report, CGS actually **discourages** PALCO's use of innovative techniques such as the Williamson drive probe method that have the potential to economically yield site specific values useful for slope stability analyses. It would have been easy to assess the effects of geotechnical parameter variability, precipitation variability, and logging effects (e.g., root strength loss and increased soil moisture) using widely known methods. Equally useful empirical methods— for example a rigorous statistical evaluation of the geotechnical, geological, silvicultural, and hydrological variables influencing slope stability— were also not used in the Freshwater South 23 THP.

The Mass Erosion section of the cumulative effects document states that logging would, by removal of "root support", change slope hydrology and the shear strength of slopes within inner gorges but does not explain why the same processes would not occur in slopes that lie outside of inner gorges. The document further states that leaving the inner gorges uncut will maintain root strength, minimize detachment and transport of soil, and provide the canopy necessary for future evapotranspiration and reduction of potentially destabilizing pore water pressures. It is not clear to the Panel why intuitive reasoning or unsubstantiated professional judgement might be sufficient to adequately analyze such a complicated geotechnical problem and, moreover, lead to a reliable conclusion that logging would destabilize some slopes but not others.

Finally, the Panel recalls that, during our October 2002 meeting in Eureka with CGS representatives, we were told by Mr. Marshall and Mr. Short that site specific soil sampling and quantitative slope stability analyses would be required to make an adequate assessment of the effects of logging on slope stability. In light of that statement and the complete lack of site specific soil sampling and rigorous slope stability analyses in an exemplary THP, the Panel does not see how it can offer any assurance that the currently existing THP preparation and review process protects water quality.

4. On page 15 the Panel cites Ardizzone at al (2002) as apparent justification for the Panel's stated opinion that the geologic assessment methodology in current use is subjective and prone to considerable error. This is done in spite of Ardizzone et al's lead-in statement to their conclusions section that states "Many studies world wide have demonstrated that traditional geomorphological investigations in the lab… and in the field… are the best tool for identifying and mapping landslide deposits." Please explain why the Panel chose to disregard one of Ardizzone et al's primary conclusions.

First, as Ms. Bedrossian correctly wrote in her question, the quoted passage is the introductory or lead-in statement in the conclusion section of the Ardizzone et al. paper. It is, however, an assertion and not a conclusion inferred from their study. Therefore, it makes no sense to ask why the Panel chose to disregard a primary conclusion that is, in fact, not a conclusion at all.

Second, the Panel thinks it important to clarify that "best" does **not** mean ideal, effective, or even useful. It simply means that something is better than the alternatives. In that regard, the Panel agrees that field and aerial photo based landslide mapping is a valuable tool and may arguably be better than some or all of the alternatives. The Panel also notes, however, that Ardizzone et al. (2002) begin their paper with a statement that makes it very clear that they do not consider landslide maps to be without considerable uncertainty and error:

> *"During the past two decades, investigators have highlighted the inherent errors and uncertainties related to the identification and mapping of landslide deposits through geomorphological techniques."* (Ardizzone et al., 2002, p. 3)

Ardizzone et al. go on to write that trained scientists can detect many or most landslides in an area, but also state:

> *"However, old dormant landslides, landslides intensively modified by farming activity or covered by dense vegetation, cannot be easily identified and correctly mapped" (Ardizzone et al., 2002, p. 3)*

Thus, the Panel cannot imagine that it was the intent of Ardizzone et al. to imply that field or aerial photo based mapping is a highly reliable method of hazard assessment. In fact, the results of their study show that it is not particularly reliable and much of their effort was devoted to the use of modern statistical methods to objectively and quantitatively evaluate the factors contributing to landsliding over wide areas such as watersheds. In their words (boldface added):

> *"The comparison of these models demonstrates that statistical modeling greatly minimizes the impact of input data errors which remain, however,* ***a major limitation on the reliability of landslide hazard maps****" (Ardizzone et al., 2002, p. 3)*

The Panel encourages interested parties to read the paper in its entirety. With regard to the specific question posed by Ms. Bedrossian, though, the Panel thinks it is very clear that they did not disregard any significant conclusions in either the letter or the spirit of the Ardizzone et al. paper.

5. Please explain why the Panel chose to cite the 80 percent mixmatch rate without Ardizzone et al's clear caution that their agreement index "appears to be too conservative and 'pessimistic' for comparing inventory maps"?

The Panel cited the 80% mismatch rate because that is what is found when landslide inventory maps are overlain and compared. Ardizzone et al. wrote that the 80% value is too pessimistic if "…landslide deposits are aggregated into a morphologically-meaningful terrain unit…" (Ardizzone et al., 2002, p. 13). In that case, the mismatch rate can decrease to something in the range of 20 to 25%. Maps such as CGS Open-File Report 99-10a (Relative Landslide Potential Map, Freshwater Creek, Humboldt County, California) appear to be more like landslide inventory maps to which hazard ratings have been assigned than geomorphologic terrain unit maps, hence it is reasonable to associate them with the higher end of the mismatch rate spectrum. CGS has, in fact, criticized PALCO's attempts to develop analyses based on meaningful terrain units (and which, following the conclusions of Ardizzone et al., might be expected to have more reliability and lower mismatch rates). The Panel also notes that the lowest mixmatch rate reported by Ardizzone et al., 15.5%, was obtained by comparing the results of multivariate statistical models that used inventory maps as part of their input.

6. On Page 15, the Panel appears to use Wills and McCrink (2002) as an example of why geologic mapping and on the ground field inspection are not appropriate for assessing landslide hazards … Does the Panel advocate not using regional and site specific geologic mapping to identify landslide hazards? If so, please explain why.

The Panel emphatically does **not** advocate the abandonment of geologic maps to assess landslide hazards. It is simply pointing out that geologic maps are imperfect tools that are highly dependent on the experience of the geologists making the maps and, in the case of hazard maps, can contain a highly subjective component of professional judgement. Therefore, it is difficult to establish the degree to which they can be relied upon to protect public safety and environmental quality. A more optimistic interpretation of the Panel's Report is that geologic maps can form the cornerstone of a comprehensive landslide hazard assessment approach that integrates the results of spatially distributed multivariate statistical models, spatially distributed morphometric models that compare attributes such as slope angle and curvature to slope instability in a watershed, and process based models that encapsulate the basic physics of slope stability. Each of the components has its own strengths and weaknesses, but taken together they have the potential to become a powerful tool for effective hazard assessment. All of these approaches, moreover, have been described in the geologic literature.

7. On page 15 the publication Pyles et al (1998) is cited as asserting "predicting where landslides will occur is not well understood"….We could find no such discussion on landslide occurrence prediction in this publication. Did the Panel cite the correct reference?

The correct reference was inadvertently replaced in the reference list by a different publication co-authored by Professor Pyles in 1998. The document to which the Panel referred is M.R. Pyles, P.W. Adams, Robert L. Beschta, and Arne E. Skaugset, 1998, *Forest Practices and Landslides: A Report prepared for Governor John Kitzhaber*.

8. If the reference to Pyles et al (1998) is correct, it appears that the Panel is using the reference to justify why geologic mapping and on-the-ground field inspections are not appropriate for assessing landslide hazards. If this is so, then the Panel assertion conflicts with the concluding paragraph of Pyles, et. al, quoted below: "Given the variability….to the extent practicable". Please explain what the Panel means by quoting Pyles et al (1998).

Please see the response to the previous question. Regardless of the reference that was cited, the Panel did **not** write or imply that geologic mapping and on-the-ground field inspections are inappropriate. In fact, quite the opposite is true. In its response to Question C, the Panel wrote that some of the current problems could have been avoided if mass wasting inventory or hazard assessment maps had been available in the early stages of the HCP negotiation process.

9. As discussed on page 23, the Panel does not appear to recognize that the Reid model makes the assumption that all sediment impacts come from the harvest units…Additionally, the Reid model oversimplifies the geologic and topographic controls on landsliding by treading all areas harvested equally. These factors were pointed out in the 1/23/03 Memorandum from the State Geologist to the NCRWQCB regarding the Phase I Report. Please explain why the Panel does not appear to address or recognize these earlier comments.

The Panel has thoroughly evaluated Dr. Reid's approach and derived her equations from first principles, and is therefore confident in its understanding of what is and is not assumed. The Reid approach considers landslides that originate on both logged and unlogged (or recovered) lands, and allows for the existence of no-cut zones that have a high potential for landsliding but will not be logged. As such, the Panel sees no basis for the assertion that the Reid approach assumes all sediment to come from logged areas. It simply does not follow from the mathematics of the problem. The Panel also points out that, as shown by Dr. Reid, her approach can be easily extended to include sediment generated from roads.

The point at which any model, mathematical or conceptual, becomes oversimplified is subjective and open to debate. It is true that, in its initial formulation, the Reid approach did not distinguish

differences in geology and topography among logged and unlogged (or recovered) areas. This is why the Panel very clearly recommended in both its Phase I and II Reports that the approach be expanded to account for geologic and topographic variability. To do so would be a simple extension of the existing approach if good quality geologic and topographic maps were available. The Panel also recommended in its Phase I Report that exploratory data analysis be conducted to determine the sensitivity of the results to geologic and topographic variability, with the aim of identifying the optimum balance between generality and detail.

10. On pages 23 through 26, the Panel relies heavily on information from Klein (2003) … CGS is unable to locate the Klein reference in any scientific journal on the [web]. Please explain why the Panel chose to rely so heavily on this obscure reference.

Klein's work is summarized in a handout distributed at the May 5, 2003 Workshop, the purpose of which was to identify all sources of potentially useful information regardless of its publication status. Had the Panel considered only documents published in refereed journals, it would have had to exclude monitoring data from PALCO and many reports produced by government agencies such as CGS. The Panel chose to cite Klein's work because it appears to represent a promising way of establishing turbidity standards that have direct relevance to beneficial water uses, and would very much like to see it submitted for publication in a refereed journal.

The Panel has pointed out that the studies of Klein and Trush link rates of timber harvest and forest roads with turbidity, and turbidity levels could be linked to chronic stress on salmonids. Therefore, this approach shows promise as a possible strategy for developing TMDLs, a strategy that merits more investigation.

11. Additionally, please identify how the work done by Klein takes into account the variability of geology between and within individual watersheds in the comparisons of turbidity thresholds.

The results presented by Klein do not explicitly take into account geologic variability among and within watersheds, although the approach could certainly be modified to do so by identifying watersheds or portions thereof with relatively uniform geology and establishing a more detailed turbidity sampling network.

That having been stated, Klein's data show that geologic variability may not be particularly significant in the watersheds that he studied. The results of a multiple linear regression show that two variables (annual harvest rate as a percentage of watershed area and road density in mi/mi^2) account for slightly more than 75% of the variability of the turbidity results and that the regression line is statistically significant at the $p = 0.05$ level (which is the nearly universal

scientific standard). Therefore, all other variables (*e.g.*, geology, topography, non-logging land use practices, and turbidity measurement errors) **combined** must account for slightly less than 25% of the variability in turbidity results. Given the emphasis on solutions that are practical and affordable, the Panel cannot state with any confidence that the expense of incorporating geologic complexity would be justified. One approach might be to fund a pilot study in which Klein's existing data are compared with published geologic maps and topographic maps to determine how much of the remaining 25% of the variability might be explained by incorporating those variables.

The Panel also notes that the quantifiable uncertainty associated with linear regression models such as those used by Klein can be used to establish probabilistic thresholds that implicitly take into account the effects of geologic variability and topography, for example by using the lower 95% confidence limit on the regression line instead of the line itself as a threshold.

12. On page 29 the discussion presented under subheading c. contains the statement "Given difficulties of making rapid judgements in forested terrain, without the benefit of subsurface investigation, it would likely be very difficult for field teams to compile scientific evidence sufficient to make more than minor adjustments to the company's plans for road relocations, landings and harvest areas". This is a very confusing statement on several levels. Who are the "teams" referred to? Are they the Plan preparers, or the reviewing agency personnel?…Would the Panel please outline their understanding of the THP process, as well as the logic for the stated conclusion?

The Panel's reference was to the team of foresters and supporting scientists preparing timber harvest proposals. It is clear from the Panel's conversations with PALCO employees and agency representatives, as well as its own professional experience, that once a timber harvest unit is identified the emphasis is on justifying why it should be logged and not on asking whether it should be logged. Therefore, it is the Panel's opinion that it would be very difficult for a mid-level field geologist to make suggestions that would significantly alter a planned harvest (e.g., by recommending that the harvest plans not proceed for a given unit or that a large portion of a harvest area be declared a no-cut zone).

13. With regard to the discussion on page 29, we are also unclear about how the subjectivity of identifying MWACs has increased. Can the Panel please explain the logic trail for this conclusion about identifying MWACs?

The reference here stems from commentary by PALCO that hazard mapping would not be performed in the future; but would be supplanted by other reports and checklists. The HCP promised a peer-reviewed MWAC methodology, and implied that watershed-wide sub-regional

mapping would help advise the decision process. The term "subjectivity" in this instance refers to the potential for reduced transparency and review, especially in regard to early-stage estimates of harvest areas and risk to water quality.

Economic Considerations

1. **Question from Carlton Yee, Registered Professional Forester** - Did the Panel consider the need to keep so many more miles of road under continuous use to achieve the required volume for financial survival of PALCO?

As noted at the Aug. 26, 2003 Workshop, the Panel recognizes the importance of economic factors; however, that was not the focus of its charge.

2. **Question from Carlton Yee, Registered Professional Forester** - Does the Panel recognize that nearly half of PALCO's lands are off limits to harvesting in one way or another?

The Panel is aware that large portions of PALCO's lands are initially restricted prior to watershed analysis, in the form of MWACs and buffer zones. We are also aware that following watershed analysis much of this land subsequently becomes available for harvest and related activities. The Panel was not charged with assessing the economic arguments for allowing greater or smaller harvest areas; we were charged with assessing from a scientific standpoint whether the existing land use planning framework can be relied upon to protect water quality. Our conclusion is that it cannot. We also made the point that science is not the only basis for land use and resource planning. Whether the economic arguments for maintaining the harvest rules as they stand offsets the scientific arguments for modifying them to better protect water quality is a policy decision – we have simply made our assessment of the strength of the scientific case for water quality protection.

3. **Question from PALCO -** The Panel enters into the policy arena by suggesting that the HCP/SYP/Forest Practice Rules' requirement of economic consideration somehow renders it unable to protect water quality (page 11, section 2b). Is it the Panel's position that the Porter-Cologne Water Quality Control Act (which provides for the authority of the State and Regional Boards) does not allow for consideration of economic impacts? If so, what is the basis for such a conclusion? If not, why wasn't this point given equal attention in the Report?

This was addressed at the Aug. 26, 2003 Workshop. The Panel does acknowledge that other factors e.g. economics can be used to guide agency decisions. The Panel's charge was to address the science basis of the questions.

Literature Review

1. **Question from David Bischel, CFA -** Who provided the literature for use by the Panel?

This was addressed in the Terms of Reference and at the Aug. 26, 2003 Workshop.

2. **Question from David Bischel, CFA** - Are there written records of the literature provided to the Panel?

This was addressed in the Terms of Reference and at the Aug. 26, 2003 Workshop. The Phase II Report bibliography and supplement lists both written and digital references submitted to the Panel (see bibliography and supplement attached below).

3. **Question from David Bischel, CFA** - Our initial review indicated several major relevant publications were not included in the literature cited. Experts with strong qualification will probably provide you a list of such relevant citations. Was the Panel charged with review of all relevant literature or a selected list?

As explained at the Aug. 26, 2003 Workshop, the primary method used to secure information for Phase II was to request it directly from PALCO and the implementing agencies. While the Panel did refer to a wide range of literature, its focus was on those documents that claimed to provide the science basis for the HCP/SYP/THP process. Regional Board staff assembled the primary bibliography for Phase I. Panelists themselves supplemented the bibliographic references for both Phases of work.

4. **Question from David Bischel, CFA -** If a selected list, who determined that list of citations?

As explained at the Aug. 26, 2003 Workshop, the primary method used to secure information for Phase II was to request it directly from PALCO and the implementing agencies. Regional Board staff assembled the primary bibliography for Phase I. Panelists themselves supplemented the bibliographic references for both Phases of work.

5. **Question from PALCO -** The Panel's review of published references that would be relevant to the issues reviewed appears to have been very limited. Was the Panel aware of the significant body of research relative to the effectiveness of forestry BMPs? If so, why wasn't this information used?

This was explained at the Aug. 26, 2003 Workshop.

6. **Question from George Ice, NCASI** - [Did the Panel consider] numerous studies…showing…use of BMPs…reduce any water quality impacts observed, even for intensively managed watersheds[?]

This was explained at the Aug. 26, 2003 Workshop. Citations to studies which may not have been familiar to the Panel fall into the category of data supporting the effectiveness of the HCP, which the Panel requested from PALCO and other stakeholders prior to the May 5, 2003 Workshop. No particular studies were recommended.

In regard to the effectiveness of BMPs, the Panel elaborates that BMPs are developed through a normative process that weighs, evaluates, and incorporates many types of information. Consequently, BMPs represent compromises in social, political, economic, and ecological goals for management of aquatic habitats. During the period between 1970 and 1990, while BMPs developed through the process of compromise were in effect, the quality of riparian and aquatic habitats in the Pacific Northwest and Northern California declined. The relationship between logging and fish habitat was extensively studied during the period. Some studies found that salmonids species responded positively to environmental changes at one life history stage, but any gains were lost because of negative responses at a subsequent life history stage. The Panel is not aware of any examples in the peer-reviewed literature where salmonid populations or salmonid habitats responded positively to intensive timber harvest activities, even with BMPs in effect.

Recovery and Background

1. **Question from David Bischel, CFA** - There is a great deal of emphasis by the Panel in the report concerning "recovery" and "background." What is meant by "recovery" and "background"? Do these "recovery" and "background" levels recognize the variations based upon seasonal changes, peak flows, reduced flows, flood events, periodicity of flood events, and changes in channel morphology resulting from cyclical flood events?

As noted on page 18 of the Phase II Report and at the Aug. 26, 2003 Workshop, definition of “recovery” includes several elements, including policy guidance on what constitutes background.

Sediment Budget Models

1. **Question from David Bischel, CFA** - The sediment budget method advocated by Reid seems to have the Panel's support. Is the Panel aware of any large-scale land management effort that uses her method? If so, what are those land management planning efforts?

This was addressed at the Aug. 26, 2003 Workshop.

2. **Question from David Bischel, CFA -** Are the Panel members aware of any peer-reviewed papers published on her (Reid's) sediment budget method?

Reid's method was peer-reviewed for accuracy both by the Panel and by Professor David Montgomery, amongst others. The Panel is not aware of specific published papers on the specific budget method that we reviewed in the Phase I Report, because these were calculations prepared at the request of the North Coast Regional Water Quality Control Board, namely:

Reid, L. M. 1998a. Calculation of Appropriate Cutting Rate in Bear Creek Watershed. Unpublished report prepared for the California Regional Water Quality Control Board, Santa Rosa, California.

Reid, L. M. 2000. Calculation of Appropriate Cutting Rate in North Fork Elk River Watershed. Unpublished report prepared for the North Coast Regional Water Quality Control Board, Santa Rosa, California.

However, there are many papers that Reid has written on general methods for sediment budget methods. Some of the more prominent are:

Reid, L. M. and T. Dunne, (1996), Rapid Evaluation of Sediment Budgets, Catena Verlag GMBH, Reiskirchen.

Reid, L. M. 1998. Calculation of average landslide frequency using climatic records. Water Resources Research 34(4): 869-877.

Reid, Leslie M. 1998. Chapter 19. Cumulative watershed effects and watershed analysis. Pages 476-501, in: Naiman, Robert J., and Robert E. Bilby, eds. River Ecology and Management: Lessons from the Pacific Coastal Ecoregion. Springer-Verlag, N.Y.

Reid, Leslie M. 1998. Cumulative watershed effects: Caspar Creek and beyond. In: Ziemer, Robert R., technical coordinator. Proceedings of the conference on coastal watersheds: the Caspar Creek story, 6 May 1998; Ukiah, California. General Tech. Rep. PSW GTR-168. Albany, California: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 117-127.

Reid, Leslie M. 2001. Cumulative watershed effects: Then and now. Watershed Management Council Networker 10(1): 24-33.

Many are listed (and available online) at: http://www.rsl.psw.fs.fed.us/pubs/onlinewater.html

3. **Question from David Bischel, CFA** - Are there other models that have been peer- reviewed and used to help describe cumulative effects for analysis of forested land use planning options?

This was addressed at the Aug. 26, 2003 Workshop. To elaborate, a large number of models have been developed to help describe cumulative watershed effects (CWEs) for analysis of forested land use planning options. These models vary in their type (empirical, weighted indices, use intensity indices, checklist, physical process, etc.); geographical area of application (northern Idaho, Montana, eastern Washington Cascades, California, etc.); precision (qualitative, quantitative, semi-quantitative); degree to which they have been tested, appropriate watershed size; predicted variable (water yield, peak flows, smolt production, sediment, etc.); input variables (monitoring, field work, aerial photos, published equations, dateable deposits, historical records, etc.); time frame (specific events, long-term averages, etc.); and level of expertise needed. It was beyond the scope of the Panel's work to conduct a complete review of the literature on CWEs, but such reviews by others do exist.

Cumulative Effects

1. **Question from PALCO -** On page 19, the Panel discusses scale issues. In the Panel's opinion, at what scale is analysis sufficient to examine recovery of wild salmon? Is it at the scale of any or all of the five watersheds? Smaller? Larger?

Fred Everest discussed the relationship between the five watersheds and ESUs at the Aug. 26, 2003 Workshop. From an ecological perspective, it is important to retain all of the genetic variability of salmonid populations within the ESU. Therefore, a scale for examining recovery of wild salmon that encompasses the entire ESU and includes each individual watershed within the ESU, would reduce the risk of future listings, extirpations, or extinctions.

2. **Question from PALCO -** From a province-level perspective, how do the current activities and rate of disturbance on PALCO lands in the five watersheds fit into a cumulative effects analysis, given that the five watersheds represent less than 3 percent of the land area just in Humboldt County?

Fred Everest discussed the relationship between the five watersheds and ESUs at the Aug. 26, 2003 Workshop. The Panel, however, was not asked to address how disturbances in the five watersheds fit into the context of CWE for Humboldt County. This is a valid question and perhaps one that PALCO, NMFS, and CDF&G should address.

3. **Question from PALCO -** In trying to explain why this Panel's report is valid -- even though it contradicts the conclusions of the Dunne report -- the Panel concludes "the time required to implement the recommendations of the Dunne report would pose a problem relative to the current rate at which the five watersheds are currently being logged" (Page 57, paragraph 1). In fact, the Dunne report was compiled explicitly to review the issues related to the Freshwater Creek watershed with full recognition of the HCP/SYP/FPRs, the sediment water quality, rate of harvest and flooding issues in Freshwater. Many of the recommendations in the Dunne report are valid and have been followed. On what scientific evidence was the Panel's conclusion on this matter based?

The Panel report does not contradict the conclusions of the Dunne report – it clearly supports them (see page 60). The Dunne report makes 11 key recommendations, of which at least 10 have not been acted upon at present. A key point made by the Dunne report, and echoed in our report, is that cumulative effects on water quality must be assessed in a scientifically rigorous way in advance of harvest activities rather than at the THP scale.

Since timber harvest activities are well under way in the five watersheds, and many of the recommendations would take several years to implement, it seems reasonable to conclude that implementation of the Dunne report recommendations is unlikely to make a significant impact on water quality related activities in that location.

Impacts on Fish

1. **Question from PALCO -** The report makes the point that salmonids are more susceptible to negative effects of high turbidity when it occurs during the "prime summer rearing period" and during "periods when waters are normally clear." Did the Panel receive information that suggests elevated turbidity levels in the five watersheds during these times?

Review of the technical literature indicates that elevated turbidity levels can affect feeding, growth, condition, and corticosteroid stress responses in juvenile salmonids. The effects can be magnified if acute or chronic turbidity occurs during periods when clear waters would normally be expected. The Panel did receive information (from Kline and Trush) that at least in Freshwater Creek, turbidity levels that could effect salmonid health were exceeded more frequently that in less disturbed watersheds like Prairie Creek.

2. **Question from PALCO -** The Panel suggests that a critical time is approaching for ESA-listed northern California anadromous stocks, 2015-2020 (the next Pacific Decadal Oscillation). They state that if the five watersheds have not recovered by that time, extinctions could result. What scientific evidence exists to support this conclusion? What evidence exists to suggest that these five watersheds hold the absolute key to the ESA-listed northern California anadromous stocks, given that they represent a small fraction of the ESU? Is there evidence that during the previous period of adverse ocean conditions anadromous fish became either extinct or endangered on PALCO lands despite the presence of logging activities that in many cases were far more impactful on the environment than those currently being used?

Fred Everest addressed the relationship between the five watersheds and ESUs at the Aug. 26, 2003 Workshop.

3. **Question from PALCO -** The report (page 21, paragraph 1) speculates that "If fresh water habitats in the watersheds have not recovered by that time, the fish will simultaneously face both degraded freshwater habitats and an unproductive ocean." What evidence does the Panel believes supports this speculation, given that evidence was provided to the Panel indicating that substantial salmonid spawning and rearing activity is occurring in most of these watersheds?

This was discussed at the Aug. 26, 2003 Workshop. "Substantial" salmonid spawning and rearing in the five watersheds is too undefined to be a useful measure of fish population health. A more meaningful measure would be quantification of the number, size, and condition of smolts exiting the watersheds. Coho numbers in California are now at about one percent of their former levels, and coho populations within the ESU that encompasses the five watersheds are listed under the ESA. At the watershed scale, fresh water habitats in the five watersheds are degraded. If that degradation continues into the next negative phase of the Pacific Decadal Oscillation (PDO) in California, the fish will simultaneously face the double jeopardy of poor freshwater and poor marine habitats.

4. **Question from PALCO -** The two Klein curves are identified by the Panel as a promising approach to developing sediment thresholds within basins (page 24). Does the Panel believe that differences in geology, topography, storm intensity, or other factors could influence these curves? If so, why did the Panel fail to acknowledge the potential role of these variables, and fail to specify that any use of the Klein approach needs to consider these variables? If not, what scientific basis was used to reach such a conclusion?

This question was addressed at the Aug. 26, 2003 Workshop. The Panel does acknowledge the potential role of these variables. See the response to the CGS question on geology and

topography. Klein's regression model, which is statistically significant at the 0.05 level, suggests that all of those factors **combined** will account for no more than 25% of the variability of the turbidity. Just two variables, area logged and road density, combine to account for more than 75% of the variability. Additionally, Klein's approach could be easily expanded to address those additional factors if it were deemed necessary.

5. **Question from PALCO -** The report suggests that Klein's work correlated turbidity with *fish abundance*. Actually, Klein uses findings from laboratory experiments that related turbidity levels to fish stress only. Did the Panel consider or collect information on fish abundance within the five watersheds? Does the Panel know of similar studies on salmonids that relate acute or chronic stress levels of turbidity to actual population abundance?

Klein did two things. First he reviewed the scientific literature and determined a turbidity threshold level ($\geq$25 NTU) that was demonstrated to have negative effects on salmonids. Second, he plotted annual rate of timber harvest in eight Northern California watersheds against turbidity produced by the watersheds. The plot indicated the level of harvest that caused a threshold turbidity of 25 NTU to be exceeded 10% of the time. The Panel suggested that this approach might be further developed to link turbidity with fish abundance.

6. **Question from Ken Miller, HWC -** Genetically viable stocks of coho inhabit only 7 or so watersheds in this ESU. These five watersheds constitute 3 of these (FW, Elk and Eel) and are only watersheds available for coho straying from two other coho streams: Mattole and Prarie Creek. Coho have limited stray ability. If these watershed habitats become inhospitable to coho, would that not jeopardize coho stocks substantially in this ESU?

Yes, if habitat in these watersheds becomes inhospitable, the risk to future viability of coho will increase within the ESU.

7. **Question for Dr. Fred Everest from Mark Rentz, California Forestry Association -** [Referring to graph of FW habitat quality graphed against time] - Where is the year 1975 when the Forest Practice Rules were implemented? Your graph implies the continually changing FPRs to provide additional protection has no effect on Freshwater Habitat Quality.

The graph demonstrated on the whiteboard was a general relationship that could be applied to western Washington, Oregon and northwestern California. Disconcerting as it may be to the promulgators of the Forest Practices Acts in the three states, freshwater salmonid habitat quality did continue to decline for many years following passage of the acts and frequent revisions of FPRs and BMPs. Recovery remains uncertain.

Watershed Analysis

1. **Question from PALCO -** The authors relate that the Freshwater watershed analysis documents reveal "significant" rates of road construction and timber harvest in the last five years (page 2, paragraph 4). However, the watershed analysis did not include any evaluation of harvest rates or impacts following 1997. Regardless, the Panel goes on to make the definitive statement that this has resulted "in significant sediment production that has a cumulative watershed effect." What, if any, data did the Panel review relative to these activities in the past five years (under the HCP) that supports this conclusion? What data support the conclusion that the watershed is "cumulatively affected?"

The last 5-year period of record on harvest rates provided to the Panel ended in 1997. The legacy effects from that five year period, and earlier timber harvests, remain on the landscape and in stream channels where they are exposed to additional human and natural disturbances that can cumulatively contribute impacts to downstream waters.

2. **Question from Cynthia Elkins, EPIC -** Both Freshwater and Elk drain into Humboldt Bay, where sediment input is not analyzed as part of the watershed analysis. In your view, does sediment delivery in Freshwater and Elk carry the potential of degrading Beneficial Uses of Humboldt Bay, and should sediment loads in the Bay be analyzed as part of the watershed analyses for these watersheds?

This is a valid question but outside the scope of the Panel's mandate.

3. **Question from Ken Miller, HWC -** You state that a shortcoming of this process is that the high rate of logging proceeds before yet you indict the only WA. That has gone on for prescriptions - Freshwater because it fails to evaluate overall impacts, relies on WEPP, and ? interim prescriptions without scientific basis.

The Panel did not perform an extensive analysis of individual prescriptions, but did comment that the watershed analysis process lacked a critical feedback component that would test (as opposed to speculate on) the effectiveness of prescriptions.

<u>Monitoring and Enforcement</u>

1. **Question from PALCO -** The Panel sets up an impossible standard for endorsement of the Habitat Conservation Plan (page 3, paragraph 2). They indicate that a monitoring program to document the effectiveness of the HCP "will take years or decades to fully implement" yet on the other hand, they state the HCP is an insufficient protector of water quality because such monitoring data are not available to prove its effectiveness. In other words, the Panel indicates implementation of the HCP's measures would be necessary in order to monitor

their effectiveness, yet concludes harvesting under the HCP should not occur until such data have been collected. How would a landowner go about meeting the mutually exclusive criteria of having to "prove" through monitoring that any management scheme will protect water quality without being allowed to implement such a scheme?

The central importance of monitoring in the architecture of the HCP process was described in detail at the Aug. 26, 2003 Workshop. It is the design of the HCP process itself that placed so much emphasis on monitoring of untested prescriptions. The HCP might have been structured to more fully recognize the fragility of the region and the risks of water-quality impacts, but it did not, and the RWQCB must now take that into account.

With proper planning, it would be possible to test the effectiveness of proposed new practices by small scale implementation and monitoring before widespread application of new and untested practices to the landscape. At the minimum, effectiveness monitoring that began when new practices were first applied would provide more timely answers on effectiveness than deferred onset of monitoring as is the case with the HCP.

2. **Question from PALCO -** The Panel quotes from the HCP about the level of monitoring that will be conducted (page 10, paragraph 1). For example, the Panel quotes the draft HCP as saying "one or two pilot turbidity monitoring stations" will be included. In fact, last year PALCO operated at least 25 such stations. Given that these stations were, in many cases, installed at the request of the Regional Water Board staff and PALCO provided maps showing their placement, how can the Panel not acknowledge the existence of these turbidity stations?

The Panel presented PALCO's summary of this monitoring data at the Aug. 26, 2003 Workshop. The table that the Panel presented did not have turbidity data, although it did have other sediment data. PALCO did not offer any turbidity data for our consideration.

3. **Question from PALCO -** The Panel concludes "the watershed analysis provides no quantitative measurement-based assessment of prescriptions to limit sediment production from those processes identified as being responsible for increased sediment inputs" (page 37, paragraph 3). In fact, quantitative estimates of the benefits of the Freshwater prescriptions were prepared and provided to the Panel and a monitoring program to assess the effectiveness of those prescriptions has been developed. Why did the Panel fail to acknowledge this? Given this information, on what basis does the Panel conclude that the "feedback loop" is incomplete?

Estimates of effectiveness are **not** the same as measurement-based assessments of the effectiveness of prescriptions as they are implemented on the ground. A "quantitative estimate" is not a quantitative measurement.

4. **Question from Trinda Bedrossian, CGS -** Is the Panel aware of the Board of Forestry Monitoring Study Group and the various monitoring study reports summarized by CDF?

The Panel was not aware of a Monitoring Study Group, as we did not receive any documents referring to this process.

5. **Question from Trinda Bedrossian, CGS -** How will pulse events [ie. Landsliding, storms, etc.] affect water quality monitoring?

Pulse and press events, together, must be considered in any monitoring plan. Pulse events would certainly be expected to increase turbidity, and a properly designed and implemented monitoring program would be undertaken with that in mind. Paired watershed studies, however, can be used to separate pulse from press effects. The variability associated with systems subject to both pulse and press disturbances requires long-term monitoring for meaningful results.

6. **Question from Cynthia Elkins, EPIC** "…it is the Panel's conclusion that it will take at least 5 to 10 years of data collection before there are enough data…with the current rate of logging, this could make engaging in monitoring activities a moot point." Please elaborate on this point and describe what the Panel meant by this.

The implication is that logging has been progressing at a high rate, and that chances for meaningful remediation might pass by the time enough data is collected and analyzed for it to be of any use.

7. **Question from George Ice, NCASI -** [Why does] the ISRP Report [demand] extraordinary levels of monitoring data to "certify" the effectiveness of mitigation measures[?]

The central importance of monitoring was explained at the Aug. 26, 2003 Workshop.

8. **Question from George Ice, NCASI -** [Why does] the ISRP [express uncertainty] about the potential for mitigation measures to reduce legacy conditions?

The Panel addressed this issue in detail at the Aug. 26, 2003 Workshop.

9. **Question from Alsa Levine, Coast Action Group -** If the HCP/SYP/THP process [and related inadequate monitoring] does not meet the objective of meeting water quality standards [protecting beneficial uses], would addition of other management overlays, e.g. TMDL Implementation Process help with the objective of protecting beneficial uses/water quality objectives? By helping this does not mean solving all shortcomings in the process.

Any plan or process that has a specific and enforceable objective of meeting defined water quality standards would appear to have a higher likelihood of achieving such standards.

HCP/THP Best Management Practices

1. **Question from PALCO -** The Panel states that the protection of water quality is an "incidental" goal to the HCP (page 9, section C.1). Yet, the Panel acknowledges that the HCP has as one of its goals achievement of properly functioning conditions for sediment. In fact, the so-called "PFC matrix" has standards for both bedload and suspended sediment/turbidity. If the HCP is designed to produce properly functioning conditions for sediment, then how can attainment of water quality conditions related to sediment be "incidental"?

The water quality standards that the Regional Board must attain, while including the support of salmonid populations as a beneficial use, are not defined in terms of properly functioning habitat. The Panel believes that the HCP needs to adopt standards that directly link timber harvest activities (e.g., rate of harvest and road density) to turbidity levels…and the turbidity levels need to be linked to effects on aquatic species, specifically salmonids. The Aquatic Species Conservation Plan does not make these connections. The turbidity monitoring described in the draft HCP is too limited in scope to discern the relationship between timber harvest, turbidity, and salmonids.

2. **Question from PALCO -** The Panel states "the next logical weakness identified by the Panel relates to the fallible nature of plans, which in this case are proposed courses of action or intended procedures" (page 12, item3). The Panel goes on to say that the HCP/SYP/FPRs do not provide "guarantees" that specific results will be achieved. Does the Panel know of any environmental mitigation and restoration plans that provide such specific guarantees? If so, please reference.

At the August 26 Workshop, the Panel cited several examples of resource planning processes that provide a higher degree of assurance that resource management goals will be attained. The Panel did not mean to imply that any plan can provide ironclad guarantees. However, plans can be designed to provide staged implementation based upon an open process of review and

assessment of the degree to which objectives are being achieved. At the August 26 Workshop, the five-year review of threshold attainment conducted by the Tahoe Regional Planning Agency was cited as an example. This review is supported by an inter-agency monitoring program and has provisions for public comment and discussion. The assessment culminates in written findings. There is a feedback loop, in that if certain hoped-for targets are not met, the agency's land-use permitting decisions must reflect this finding in its review of impact-causing activities during the next five-year cycle. This process is keyed to the agency's EIR/EIS obligations, and thus has formal status and transparency

3. **Question from PALCO -** The Panel goes on to say "the best that can be done is to postulate a plan based on the best available information, continually test the plan using a combination of compliance, effectiveness, and trend monitoring, and revise the plan in a timely and appropriate manner based on monitoring results" (page 15, paragraph 6). PALCO and the Wildlife Agencies used exactly that structure in designing the HCP. In what way does the Panel believe the HCP does not meet this blueprint for what should be done in constructing a plan to protect water quality?

The Panel addressed the shortcomings of the architecture of the HCP process in detail at the Aug. 26, 2003 Workshop. Additionally, a plan must be adequately implemented if it is to work as anticipated. Almost five years into the HCP, effectiveness monitoring data available for outside scrutiny are essentially non-existent.

4. **Question from PALCO -** The Panel concludes that the geologic review conducted within the THP process is unlikely to allow "more than minor adjustments" for road locations, landings, and harvest areas to address mass wasting concerns (page 29, paragraph 3). Is the Panel aware of any specific instances where the consideration of mass wasting concerns was limited when determining road locations, landings and harvest areas in a THP prepared under the HCP?

No. It would have taken an exhaustive review of submitted THPs, from conception and through review to implementation (including field notes, phone logs, and work records), to find such instances. This is far beyond the specified scope of work.

5. **Question from PALCO -** The Panel indicates that current practices related to road construction and use are resulting in significant sediment production from roads (page 44, paragraph 2). What data provides the basis for such a conclusion? Is this again based on data that pre-dates implementation of any of the HCP measures? If so, why did the Panel fail to acknowledge this?

The Panel asked PALCO to provide data that demonstrate the effectiveness of measures undertaken under the HCP. It assumes that if there were data showing that current practices are more effective than those for the most recent period of record, they would have been offered in support of those practices. None were.

6. **Question from Trinda Bedrossian, CGS** - Did any Panel member attend a pre-harvest inspection to see how the THP/HCP process works?

No. The Panel did not have the opportunity to attend a pre-harvest inspection.

<u>"Recovery" of Beneficial Uses</u>

1. **Question from PALCO -** The Panel indicates that even if the Reid model is used it "would not predict the trajectory of recovery of streams in the system where excess sediment needs to be flushed out" (page 23, paragraph 1). The HCP/SYP/FPRs were found unsuitable for protection of water quality by the Panel because they could not "guarantee the attainment" of water quality standards, yet the Panel finds that use of the Reid model will not predict, and therefore cannot guarantee, attainment of water quality standards. How does the Panel justify this obvious double standard?

The Panel identifies the Reid model, with adjustments, as a promising approach.

2. **Question from Ken Miller, HWC -** PL relies on WEPP for THPs & O'Connor modeled sediment budget despite it's inappropriateness. PL also relies on unreliable surface geologic evaluations by RPFs (in Freshwater W.A.) and REGs . Given these shortcomings - **please explain how** the amplified Reid methodology* overcomes these & increases the likelihood of recovery of Beneficial Uses. (*see ATT 22 9/00 Staff report - rate of cut calculations for n. fork Elk R.). Dr. Reid considers potential discharges of sediment from post logging, hydrologic change, mass wasting, and roads and correlates canopy removal, roads, etc. with probably sediment discharge and Basin Plan Objectives.

Dr. Reid does an excellent job of explaining how her approach works, and the Panel commented on issues such as the likelihood of operator error at the Aug. 26, 2003 Workshop.

3. **Question from Joyce King, Salmon Forever -** Would water quality and beneficial uses be improved in these watersheds if all the road were good but the forests logged (80-90% in 15-20 years at current rates)?

The scientific literature would not support the contention that water quality would be improved under these conditions.

4. **Question from Ken Miller, HWC -** What is the most important effective action RWB can take to protect and recover Beneficial Uses, including abatement of nuisance flooding in short and long term?

Answers to this question are discussed in the Panel's response to Question 2 in the Phase I Report. Question 2 asks, "What options are available (e.g. dredging, and modifications of activities resulting in, or reducing, sediment delivery) that can be immediately implemented and will be effective in lessening the adverse flooding conditions and impacts to beneficial uses? Please discuss the potential benefits, limitations, and tradeoffs of these options for each watershed."

Rate of Harvest

1. **Question from PALCO -** In one of many occurrences within the document, the Panel states that "logging disturbances continue at a high rate annually". The Panel does not acknowledge that two of the watersheds had a cessation in logging for more than 2 years following the adoption of the HCP and are now harvested under acreage limitations. How does the Panel define "high rate?" What scientific basis does the Panel use in determining that this level constitutes a high rate of logging disturbances (page 20, paragraph 2)?

As addressed by the Panel, disturbances continue to exert impacts.

2. **Question from PALCO -** The Panel discusses the Reid approach to estimating appropriate harvest levels, specifically mentioning the variable L as a constant (page 23, paragraph 1). During the Phase One Report, PALCO and its consultants provided information on why the value of L used by Dr. Reid was in fact not representative of the historic record. In addition, the value of L used by Dr. Reid was for harvesting conducted prior to implementation of the HCP and its protective measures. The Panel ignores these criticisms in the Phase Two Report. On what basis does the Panel recommend the continued use of the Reid Model without adjustments to address these flaws?

As discussed at the Aug. 26, 2003 Workshop, the Panel acknowledges both strengths and weaknesses of the Reid approach, and does recognize the need to refine the approach. As well, the Panel notes that news accounts of the Panel report inaccurately suggested that the Panel "endorsed the Reid approach." Rather, the Panel suggested that the Reid approach, with

adjustments, holds promise and deserves to be developed further. Allowing L to vary in time and/or space might be one of those adjustments.

3. **Question from PALCO -** The Panel focuses on harvest practices that occurred from 1988 to 1997 (page 40, section A). In fact, almost no harvest was conducted for over two of those five years, and lower harvest rates have been implemented subsequent to that period when compared to prior harvesting periods. Thus, the Panel has failed to consider the effects of the HCP/SYP/FPRs and subsequent agreements in regulating harvest rates below those that have historically occurred. Why does the Panel fail to include any information on harvest rates in the Freshwater basin over the past five years? Why does the Panel fail to provide any information on harvest rates for other parts of PALCO's lands? Absent such data, how was the Panel able to conclude that "logging disturbances continue at a high rate annually?"

As noted at the Aug. 26, 2003 Workshop, the Panel notes that impacts of disturbances continue.

4. **Question from George Ice, NCASI** - [Does] this report completely [ignore] findings that how, where, and when forest management occurs is equally as important as how much management occurs and that current forest practices have dramatically reduced impacts to water quality[?]

The Panel has acknowledged that PALCO has instituted many practices that may reduce the impacts of harvesting on water quality. The Panel also points out that monitoring data collection and analysis of such data are insufficient to demonstrate restoration of beneficial uses. Where forest management occurs in watersheds is important in assessing effects on water quality. Although forest practices may have reduced negative impacts on water quality in some areas, timber harvest is currently being conducted in more sensitive terrain than in the recent past. Timber companies have tended to harvest the most valuable timber from the easiest terrain first, then move to steeper and less stable lands as the source of future volume. These five watersheds have followed that pattern with early railroad logging in the valleys, followed by subsequent logging road construction and harvest in timber stands in the uplands.

5. **Question from Ken Miller, HWC -** Does not the 3-13 fold increase in harvest-related mass wasting in Bear-Jordan-n.Fork Elk demonstrated in the PL sed. source inventories demonstrate the unreliability of Reg. geologists to predict post-logging instability of apparently stable slopes before logging (all these THPs were signed off by Reg's)?

It may if the landslides occurred in areas logged after the start of geologist licensing. One would have to review specific THPs on a case-by-case basis to determine exactly what was or was not

predicted. Pyles work in Oregon has pointed out that prediction of post-logging instability is not well understood.

Stream Buffers

1. **Question from PALCO -** The Panel concludes that wider buffers are necessary for Class II and Class III streams because they are significant sources of sediment input (page 30, paragraph 2). What data were used to justify this conclusion? Andy, can you comment
2. **Question from PALCO -** The Panel notes that the ten-foot no harvest buffer of Class IIIs "is likely to be of no value for water quality purposes" (page 31, bottom paragraph). What data were used to make that finding? Equally important, the Panel seems to have failed to consider the additional areas of limited harvest and the equipment exclusion zones. Does the Panel believe that harvest limitation and reduced soil disturbance do not affect water quality? Andy, can you comment
3. **Question from PALCO -** The authors indicate necessity for a 100-foot minimum buffer on streams for protection of water quality values based on the Pajaro River example (page 31). What stream order or FPR class is the Panel referring to? What were the resources at risk and the land management activities for the Pajaro River? What is the correct citation for the source of information that the Panel relied upon to make this statement? Andy, can you comment

Response to Questions 1-3:

Buffer strips

Numerous studies show that most sediment in steep, forest watersheds enters via 1st order drainages and so-called 'zero' order basins (hollows with ephemeral drainage and seeps). These locations are the steepest parts of the watershed, have the highest degree of flow accumulation, and tend to be source areas for debris flows. Such areas correspond to Class III and Class II streams.

Much of the sediment entering the stream network in Class III streams will be in the form of debris flows coming off the slopes above. Debris flows are unlikely to be stopped by a ten-foot buffer or an equipment exclusion zone. The following recommendations come from Agroforestry Notes 4 1997, a publication of USDA Forest Service and the USDA Natural Resources Conservation Service entitled "How to Design a Riparian Buffer for Agricultural Land", written by Mike Dosskey, National Agroforestry Center; Dick Schultz and Tom Isenhart, Iowa State University.

"Filter sediment and sediment-attached contaminants from agricultural runoff
For slopes less than 15%, most sediment settling occurs within a 25 to 30 feet wide buffer of grass. Greater width may be required for shrub and tree vegetation, on steeper slopes, or where sediment loads are particularly high." Note that many of the slopes in the five watersheds are considerably steeper than 15%, that wider buffers are required for trees than for grass, and that sediment loads in these watersheds are higher than typically found in agricultural settings.

Where the issue is preventing pesticides or herbicides from reaching streams the authors recommend up to 100 ft buffers. Similarly, to protect water from thermal heating they recommend up to 100 ft buffers.

The Pajaro River is a Class III waterbody supporting steelhead. The predominant landuse is agriculture. The source for a requirement to have a minimum 100-foot buffer was Ann Riley (personal communication), San Francisco Bay Regional Water Quality Control Board. Publication was Philip Williams & Associates Report # 1675 An Environmental Alternative for the Pájaro River Flood Plan, 2003. See comments above regarding USDA recommendations for buffers to protect against thermal, herbicide and sediment effects.

4. **Question from Richard Gienger, self, HWC, SSRC** - "Stream buffers" are referenced in the report. What exactly are the inherent measures in these buffers? Is it understood that these are 'no cut' buffers? Or are there ranges of protective measures?

We have taken our use of the term stream buffers from the HCP. Buffers combine 'no cut' provisions of different widths along with reduced cut and equipment exclusion zones around them.

<u>Turbidity/Sediment</u>

1. **Question from Carlton Yee, Registered Professional Forester** - Is the rate of large flood events on sediment storage and movement cycles of streams not discussed by the ISRP?

The Panel considers the importance of large flood events on sediment storage and movement cycles in detail in its Phase I Report.

2. **Question from PALCO -** The Panel acknowledges that the Freshwater watershed analysis sediment budget was for the period for 1988 to 1997 (page 39, paragraph 1) in making the case that management practices have led to sediment production increases that are significant. Once again, the Panel fails to examine practices occurring under the HCP. Why

does the Panel fail to acknowledge that these estimates of sediment production may be high, and in fact likely are high, compared to existing practices being conducted by the Company?

The Panel specifically requested data establishing the effectiveness of current management practices, but no data of this type were provided by PALCO. On 30 April 2003, the Panel received documents that had been submitted to the NCRWQCB from Kathleen Sullivan, Senior Scientist with PALCO. These documents included a matrix of water quality monitoring stations, a map of stations, and a table listing water sampling dates (13 Feb. and 19 Feb) in Freshwater Creek. The Panel did not receive any actual data from PALCO from which it would be possible to judge the effects of more recent practices under the HCP. At the May 2003 Workshop in Eureka, Ms. Sullivan noted that those data were not yet available. As of August 2003, the Panel still had not received any sediment data.

3. **Question from PALCO -** In reporting a relationship of 9.6 for Bear Creek, the Panel again fails to acknowledge that this rate relates to landslide occurrences observed prior to implementation of HCP practices (page 49, paragraph 3). In fact, it is only possible to achieve such a high rate by focusing on a very limited time set from within a 20-year record. Is the Panel advocating that in analyzing landslide occurrence on managed lands that only very small periods of time be utilized despite the significant potential to overestimate or underestimate true landslide rates? Similarly, is the Panel advocating that landslides rates that occurred under historic logging practices should be used to indicate those that would occur under the more protective measures of the HCP?

No, the Panel is not advocating the use of methods that have the potential to significantly increase uncertainty. The Panel would very much like to see data that would allow determination of landslide rates under current practices, but none were made available despite requests to PALCO to provide that kind of information.

4. **Question from Trinda Bedrossian, CGS -** Do you have any ideas on how to distinguish turbidity from the in-channel erosion vs. slope/landslide process?

Yes, but not based on turbidity alone. It might be possible to trace sediment sources from suspended sediment sampling. Monitoring and observing would be required at many locations within the watersheds in order for sources to be identified.

5. **Question from Shirley Shelborn -** How does erosion - both chronic surface erosion and mass wasting - affect long- and short-term timberland productivity?

The Panel was not asked to address this question. Where either of these types of erosion remove substantial amounts of soil, short-term timberland productivity would be reduced. In the long term, soil formation activities can restore productivity levels, but the time frame may be centuries.

6. **Question from Cynthia Elkins, EPIC -** MWACs do not include dormant landslides. Is it your view that logging operations on dormant landslide areas have potential to trigger mass wasting events? Do you believe it is appropriate to exclude dormant landslides from MWACs? Please also comment on the appropriateness of surface observational methods.

Surface observational methods are addressed in response to several of the CGS questions. It is the opinion of the Panel that specific dormant landslides should be excluded only if it can be demonstrated, through quantitative slope stability analyses supported by site specific geotechnical data, that the combination of logging, likely storm events, and likely earthquakes have a low probability of reactivating the dormant landslides. Such determinations are fully within the realm of modern engineering geologic and geotechnical engineering practice, although they are not routinely employed in northern California. Whether or not logging operations have the potential to reactivate dormant landslides should be evaluated on a site-specific case-by-case basis.

Potential Applicability of Findings to Other Watersheds

1. **Question from Cynthia Elkins, EPIC -** The watersheds addressed in this report are but 5 of many on PL's land. In your view, would the findings of this report be applicable to other watersheds that have the same geologic conditions, logging history, and current logging rates?

Yes, it is the Panel's opinion that they may be generally applicable if the similar conditions were extended to include climate, latitude, and vegetation. Given similar watersheds, logging history and logging rates, there is no reason to believe that the Panel findings would differ.

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